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WIRELESS SIGNAL LOSS DETECTION

FIELD OF THE INVENTION

5   The present invention relates generally to wireless communications, and more particularly to wireless signal loss detection.

DESCRIPTION OF THE RELATED ART

10   Many consumers want to enjoy a vast collection of digital audio files stored on their PC by playing those audio files on an audio system. Users have already been transferring audio files from CD storage onto their personal computers. Playing audio files directly from an Internet web site through a personal computer to a home audio system permits using the computer's processing and storage capacities to increase play lists, as well as organize a

15   library of digital music files using ID3 tag song data to display artist, album, song title and genre. Wireless transmission and reception between a personal computer and the audio system would permit a higher quality listening experience for a user

        Wireless transmitter and receiver techniques must be able to send CD-quality digital

20   audio from the personal computer to the audio system. Active users of jukebox-managed personal computer content and Internet audio listeners seeking alternatives for listening to digital quality music files require a convenient connection between their personal computer and audio system. Continuous transmission and reception between the audio file source and the audio system is required for full user experience in listening to digital quality music files

25   available from a personal computer or a network site.

        Wireless transmission techniques applied to audio files transmitted to a wireless receiver can cease its decoding after long periods of transmission idleness from the audio file transmitter source. A phase lock loop in the decoding by the receiver can unlock. Loss of the

30   phase lock loop by the receiver would require the user to manually re-establish a phase lock loop in the decoding of audio file transmissions from the transmitter. Accordingly there is a need for detecting signal loss between the receiver and the signal transmitter and

automatically resetting a signal phase lock to maintain near seamless playing of audio files received over a wireless communications link.

SUMMARY OF THE INVENTION

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The present apparatus includes a receiver for receiving an audio file signal, a decoder for demodulating the audio file signal, and a processor for polling the decoder for a loss of a phase lock in the demodulating of the audio file signal. The processor resets and reinitializes the decoder in response to the loss in the phase lock loop. The receiver includes 900 MHz

10   radio frequency reception circuitry. The decoder comprises an eight-to-fourteen modulation EFM decoder. In a preferred embodiment, the decoder outputs a digital audio stream that conforms to a known I2S audio stream format.

The present computer readable medium contains software instructions that, when

15   executed by a processor, perform the steps of receiving a modulated audio file signal, demodulating the modulated audio file signal, polling the demodulating for a loss in a phase lock in the demodulating, and resetting and reinitializing the demodulating in reply to the loss in the phase lock. The demodulating is preferably a demodulation of an eight-to-fourteen EFM bit digital encoding synchronized to a 900 MHz range carrier frequency

20   modulated by the digital encoding

A method for detecting a signal loss in a wireless audio file signal transmission includes the steps of receiving an audio file signal, decoding the audio file signal, and polling the decoder for a loss of a phase lock in the decoding of the audio file signal. In

25   response to the loss in the phase lock in the decoding the decoder is reset and reinitialized. The step of receiving, preferably, is synchronized to a 900 MHz range carrier frequency modulated by the audio file signal. The step of decoding includes an eight-to-fourteen bit modulation EFM decoding.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present invention may be obtained from consideration of the following description in conjunction with the drawings, in which:

FIG. 1 depicts an exemplary communications environment including an Internet network, a computer, a wireless transmitter, a wireless receiver, and an audio system.

FIG. 2 is a block diagram of an exemplary wireless receiver for implementing the invention; and

FIG. 3 depicts a wireless phase locked loop unlocked condition and recovery flow chart suitable for use in the receiver of FIG. 2;

To facilitate understanding, identical reference numerals have been used, where possible, to designate identical elements that are common to the figures.

DETAILED DESCRIPTION

FIG. 1 depicts an exemplary communications environment 10 including an exemplary network 12, such as the Internet, a personal computer 11 with wireless transmitter 13, and a wireless receiver 14. The wireless transmitter 13 transfers audio files on the computer 11 to the wireless receiver 14 over wireless medium 15. The wireless receiver then sends the analog stereo signal to the audio system 16. The audio files can be any one of various file types, such as mp3, files stored for retention during shutoff of the computer or stored temporarily when the computer serves as a conduit for transmission of audio files from across the network to the wireless receiver 14. The transmitter 13 can be an integral component of the computer's architecture or an add-on device communicating with the computer through a port connection, such as a universal serial bus connection USB. The exemplary computer 11, shown as a laptop computer, can be a desktop computer system or a processor based device capable of relaying transfer of audio files from across a network to the wireless receiver 14.

FIG. 2 is a block diagram of an exemplary wireless receiver. An incoming modulated or encoded analog signal received at an antenna 25 is received into the reception circuitry board 23 containing a frequency synthesizer for synchronizing the receiver to an exemplary

transmitter carrier frequency in the range of 900 MHz. The encoded signal is decoded by an eight-to-fourteen modulation decoder 22. Eight-to-fourteen EFM encoding is a known encoding technique for compact disk CD encoding. A digital audio stream I2S from the decoder 22 is changed by the stereo digital-to-analog converter DAC 21 into an analog stereo

5   input signal to an audio system. Communications protocols between the decoder 22 and processor 24 preferably conform to known I2C bus protocols. The processor is preferably a microprocessor tied over a microwire bus to the reception circuitry 23. The processor controls the frequency synthesizer for synchronizing the receiver to the radio carrier frequency of the audio file signal source transmitter. The processor 24 also carries out the

10   inventive wireless audio file signal loss detection and resetting and initialization of the decoder 22 when a loss of the wireless audio file signal is detected.

FIG. 3 is a flow chart for detecting a wireless phase lock loop PLL unlocked condition and recovery flow chart for use in the receiver of FIG. 2. The processor 24

15   continually polls the decoder 32 to determine if a phase lock loop in the demodulation of the incoming audio file signal has been lost 33. If the decoder's phase lock loop PLL has unlocked the processor undertakes a software reset of the decoder and reinitializes a phase lock loop condition in the decoding of the audio file signal received at the antenna 25. If the decoder's phase lock loop PLL remains locked, the processor 24 continues to poll the

20   decoder for an unlocked condition in the phase lock loop. The automatic EFM PLL unlocked condition detection and recovery allows for no user awareness or intervention requirement.

Although various embodiments which incorporate the teachings of the present invention have been shown and described in detail herein, those skilled in the art can readily

25   devise many other varied embodiments that will still incorporate these teachings. The present invention has been described within the context of an audio system receiving transmission of audio files from a personal computer. It will be appreciated by those skilled in the art that the teachings of the present invention directed to wireless signal loss detection recovery may be practiced where the wireless signal is transmitting audio files stored on the computer or audio

30   files downloaded from across the network onto the computer for streaming transfer to the audio system. The audio system can be equipped with an analog stereo input jack, e.g. a home stereo with a "LINE" or "AUX" jack, for receiving the stereo audio signal.